AB 2339 WORKING GROUP DRAFT DOCUMENT

Draft Energy Commission Policy
for
Ground Source Heat Pumps
April 19, 2013

Introduction:
Public Resources Code, section 25228 (added by Assembly Bill 2339, Chapter 608, Statutes of 2012), requires the Energy Commission, in consultation with the California Public Utilities Commission, cities, counties, special districts, and other stakeholders, to evaluate policies to overcome barriers to the use of geothermal heat pump and geothermal ground loop technologies, and to include its evaluations and recommendations in the 2013 Integrated Energy Policy Report (2013 IEPR).

In evaluating these policies and strategies, the Energy Commission shall consider all of the following:

1. The quantitative benefits and costs to ratepayers specific to safer, more reliable, or less costly gas or electrical service and through greater energy efficiency, reduction of health and environmental impacts from air pollution, and reduction of greenhouse gas emissions related to electricity and natural gas production and use, through the use of geothermal heat pump and geothermal ground loop technologies.

2. The existing statutory and permit requirements that impact the use of geothermal heat pumps and geothermal ground loop technologies and any other existing legal impediments to the use of geothermal heat pump and geothermal ground loop technologies.

3. The impact of the use of the geothermal heat pump and geothermal ground loop technologies on achieving the state's goals pursuant to the California Global Warming Solutions Act of 2006 (Health & Safety Code, § 38500 et seq.) and achieving the state's energy efficiency goals.

Public Resources Code Section 25302 requires the Energy Commission to prepare an integrated energy policy report every two years for submittal to the Governor that provides an overview of major energy issues and trends facing California. The report makes energy policy recommendations based on the Energy Commission's energy assessments and forecasts with the intent of conserving resources, protecting the environment, providing reliable energy, enhancing the state's economy, and protecting public health and safety.

This Working Group will review, comment and make independent suggestions for the Energy Commission staff to consider in recommending policies that may overcome barriers to the use of geothermal heat pump and geothermal ground loop technologies, which may ultimately be adopted by the Energy Commission and included in the 2013 IEPR.

The Energy Commission staff is especially interested in the participation of technical subject experts from the geothermal heat pump and geothermal ground loop industries (manufacturers, installers, and distributors), the California Public Utilities Commission, the Air Resources Board, and interested cities, counties, and special districts.

Initial Proposed Policies:

Staff recommends the following policies as a "first cut" based on the previous work done in the PIER funded Project Negatherm For Ground Source Heat Pumps. However, one proposal (number 3 below) is not feasible and is only being discussed in order to clarify the rational.

Issue 1. AB 2334 (Cortese, Chapter 581, Statues of 1996) amended Sections13700, 13701, 13750.5, 13751, and 13752, added Sections 13713 and 13800.5 and repealed Section 13750 of the California Water Code Public.

- Defines "geothermal heat exchange well" as any uncased artificial excavation that uses the heat exchange capacity of the earth for heating and cooling, in which excavation the ambient ground temperature is 30 degrees Celsius (86 degrees Fahrenheit) or less, and which excavation uses a closed loop fluid system to prevent the discharge or escape of its fluid into surrounding aquifers or other geologic formations.
- Requires DWR to develop recommended standards for the construction, maintenance, abandonment or destruction of geothermal heat exchange wells and by July 1, 1997 to submit the recommended standards to the SWRCB.
- Authorizes a local agency with authority over geothermal heat exchange wells to adopt temporary regulations applicable to geothermal heat exchange wells that the local agency determines to be consistent with the intent of existing DWR standards.
- Requires the SWRCB, by January 1, 1998, to adopt a model geothermal heat exchange well ordinance to implement DWR's recommended standards. Requires the SWRCB to circulate the model ordinance to all cities and counties.
- Requires each county, city, or water agency where appropriate, by April 1, 1998, to adopt a geothermal heat exchange well ordinance that meets or exceeds the recommended standards developed by DWR. If an appropriate local agency fails to adopt such an ordinance, the model ordinance adopted by the SWRCB shall take effect on May 1, 1998, and shall be enforced by the county or city.

After AB 2334 passed, the Interagency Task Force (DWR, CEC, SWRCB, CGA and representatives from the GSHP industry) met to develop standards for GSHPBs. The draft standards, Bulletin 74-99, were completed in April 1999 and were to be included in a revision of Bulletin 74-81/74-90. However, these standards were not adopted as final nor were they sent to the SWRCB.

Currently, the Department of Water Resources is re-developing the Bulletin 74-99. The Energy Commission will assist DWR in the development of these standards and ensure that they are consistent with Energy Commission policy and Building Energy Efficiency Standards.

Proposed Policy:
As the Department of Water Resources completes the original work of AB 2334, the Energy Commission staff will participate and assist with that effort.

As a sub issue, we would like the working group to submit comments on the Bulletin 74-99 definitions.

Issue 1A. The current regulatory framework for permitting "open loop" GHP ground exchangers is sufficiently onerous that open loop systems are underutilized thereby preventing GHP deployments when "open loop resources" are available.

Discussion

Proposed Policy:
The Commission should work with DWR and industry to evaluate needed regulatory framework improvements.

Issue 1B. Lack of understanding on GHP systems prevents adoption of appropriate permitting and inspection processes and fees at the local level.

Discussion

Proposed Policy:
The Commission should work with local jurisdiction and industry to create needed public information tools specific to GHPs.

Issue 1C. The definition of 'geothermal heat exchange well' as defined in Section 13700 is not consistent with the industry terminology and requires revision. Furthermore, the standards that were to be written and implemented by AB 2334 were never adopted.

Discussion

Proposed Policy:

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Encourage CEC to work with DWR to expedite the Standards process for public review and adoption (per Joe's wording)

Encourage CEC to work with DWR and the Regional Water Quality Control Board to consider industry's alternative termination definition for "borehole" in lieu of "geothermal heat exchange well.'

The Commission should work with industry to develop suitable definition for GHP technology.

Issue 2. With Staffs presentation at the March 21, 2013 Workshop, altering the way that ground source heat pumps are modeled under Building Energy Efficiency Standards requirements would come in two phases. Industry representatives, not Energy Commission Staff, must undertake these tasks. The first phase is to use the site design engineer to verify the proper installation and confirm the energy efficiency of the ground source heat pump ground loop(s) and all associated above ground device installations. The second phase is to develop new modeling rules for ground source heat pumps.

Comment: ~~I~~We disagree with the premise and the proposed solution. Given the potential benefits of GHPs the Commission should take a leadership role in removing internal barriers to GHP utilization. We instead offer this definition of Issue 2.

ISSUES:

1. ~~-~~The SEER and 'equivalent' EER rule set used to model the efficiency of water-source equipment as air-source equipment in the ACM is not correct.
2. The ACM does not prescribe rule sets for modeling geothermal heat pump systems.
3. The current Title 24 compliance tools do not support AB32 objectives.
4. The current Title 24 compliance tools do not support the State's GHG reduction, ZNE implementation, distributed generation or energy efficiency objectives, AB758 program and Prop 39 funded projects.
5. The current methodologies used by Commission-approved software providers to model geothermal heat pump systems:
   - do not exist for Residential buildings.
   - are incorrect for Non-Residential buildings.

Discussion:

For the State of California to meet its RPS goals for 2020 and to meet the ZNE goals for both Residential and Commercial Buildings, more precise representation of geothermal heat pump system efficiency in various building types and geographical locations is required to demonstrate savings to building owners, utilities and the Commission.

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In order to do this, industry in partnership with the utilities and the Commission will need to come together to swiftly make corrections or provide new rule sets to the Building Energy Efficiency Standards. The inadequacy of the current rule sets in the ACM and lack of checks and balances in the current compliance software outputs require immediate attention. Modeling, data collection, and a compilation of current modeling techniques by other widely-accepted modeling tools shall be reviewed and considered for adoption for modeling geothermal heat pumps systems against other mechanical systems.

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~~Design Engineers site verification~~

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- ~~Would use existing rule set in computer modeling tools~~
- ~~Requires development of site inspection protocols~~
- ~~Gives final word on site acceptance to design engineer~~

~~New modeling rules specific to Ground Source Heat pumps~~

- ~~Potentially more accurate modeling~~
- ~~Could include Domestic Hot Water~~
- ~~Much longer review time and extensive staff report required~~
- ~~Adds need for program to insert code and verify~~
- ~~Many more technical obstacles to validate~~
- ~~Would include site verification~~

Update:

Technical ~~staff have~~staff has engaged with representatives from the CaliforniaGeo organization to advise the industry on likely successful strategies for completing this task.

Discussion:

-The prevalence of "rule set methodology" presented by staff in the March 21 workshop, acknowledged by staff since the workshop and spoke to by non GHP industry members in Commission hearings strongly suggests the T24 compliance tools need an immediate revamping.

In the March 2012 INITIAL STUDY/PROPOSED NEGATIVE DECLARATION FOR THE 2013 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS Staff posits the responsibility for updating of the standards is the responsibility of the Commission as required by the WARREN-ALQUIST ACT.

> "*The statute requires the Energy Commission to adopt, implement, and periodically update energy efficiency standards for both residential and nonresidential buildings to ensure that building construction, system design, and*

installation achieve energy efficiency and preserve outdoor and indoor environmental quality."

"*Making future solar electric and solar thermal system installations easier is another new element of the 2013 Standards."*

Solar thermal and geothermal heat pumps are similarly aged technologies.

Solar PV is a relatively new technology.

Proposed Policy:
The Commission should aggressively improve the T24 tools in order to remove inadvertent biases against geothermal heat pumps and provide a useful compliance framework as it has done with the relatively new solar PV technology. Valuation of true geothermal heat pump efficiency is required to meet the State's energy goals. Properly modeling tools and rule set methodologies are required for all technologies. To this end the following proposals are made:

1. The Commission in cooperation with the CPUC and CaliforniaGeo shall develop new rule sets to correct current shortcomings in the Building Energy Efficiency Standards and the ACM relevant to geothermal heat pump systems.
2. The Commission shall recommend to the *Utility Collaborative for T24 Improvements* (please insert the correct name for this group) that the topic of geothermal heat pump malign be placed at the highest priority for development on their agenda.
3. The Commission shall allow other industry standard software tools for modeling geothermal heat pump systems against the baseline mechanical system, as defined in the ACM, for overall system efficiency for meeting Calgreen, Ygrene, LEED, and eligibility for utility rebates and incentives. Focus on kBTU/sf should be considered in lieu of "%-better than Title 24."
4. The Commission shall work with the geothermal heat pump industry to develop a reasonable Prescriptive approach to geothermal heat pump compliance coupled with a certificate of Compliance for both the ground heat exchanger and the geothermal heat pump. This shall be signed off by the Engineer of record. For residential projects, the installing mechanical contractor may sign off on the Certification of Compliance if there is no Engineer of Record.
5. The Commission shall develop T24 compliance tools to support AB32 objectives.

~~Proposed Policy:~~
~~The Energy Commission encourages the ground source heat pump industry representatives to either propose protocols for a site design engineer to use for verification of the efficiency of a ground source heat pump on site after construction or~~

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~~develop a new Building Energy Efficiency Standards modeling rule set specific to ground source heat pumps.~~

Issue 3. One possible solution to the overall issue of the cost of installation for the ground loop portion of a ground source heat pump system is for a utility to own the loops (possibly more of the system), lease the system to the home owner and possibly recover that capital investment with on-bill repayment over the life of the ground loop (typically 50 years). Under this scenario, it has been suggested that the Energy Commission could grant the utility an RPS credit.

However, it is not possible to grant RPS credits to non-generating energy efficiency measures such as Ground Source Heat Pumps. The Renewables Portfolio Standard program is evaluated based on the generation of electricity from eligible renewable energy resources compared to the total retail sales of a utility, as stated in the Public Utilities Code 399.12(i) " 'Renewables portfolio standard' means the specified percentage of electricity generated by eligible renewable energy resources that a retail seller or a local publicly owned electric utility is required to procure pursuant to this article." Non-generating energy efficiency measures would be incapable of producing any renewable electricity and could only provide a decrease in the retail load served by a utility.

To further confound any attempt to include a non-generation technology in the RPS program the law defines a renewable energy credit, the measure of compliance, as "a certificate of proof associated with the generation of electricity from an eligible renewable energy resource, issued through the accounting system established by the Energy Commission pursuant to Section 399.25, that one unit of electricity was generated and delivered by an eligible renewable energy resource" (PUC 399.12(h)(1)). It is also required that a 'Renewable energy credit' includes all renewable and environmental attributes associated with the production of electricity from the eligible renewable energy resource, except for an emissions reduction credit issued pursuant to Section 40709 of the Health and Safety Code and any credits or payments associated with the reduction of solid waste and treatment benefits created by the utilization of biomass or biogas fuels" (PUC 399.12(h)(2)).

While a Ground Source Hear Pump does use a geothermal energy resource, it does not generate electricity with that resource and thus is not an renewable electrical generating facility or eligible renewable energy resource.

"A geothermal heat pump is a central heating or cooling system that pumps heat to or from the ground. It uses the earth as a heat source (in the winter) or a heat sink (in the summer). It could be ***characterized as both a renewable***

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***distributed energy resource as well as an energy efficiency resource**, since it uses geothermal heat to reduce a building's electricity requirements."*
Source: CPUC AB 2339 Analysis

The Commission's website, www.consumerenergycenter.org, states:

*"Studies show that approximately 70 percent of the energy used in a geothermal heat pump system is **renewable energy from the ground.** The earth's constant temperature is what makes geothermal heat pumps one of the most efficient, comfortable, and quiet heating and cooling technologies available today. While they may be more costly to install initially than regular heat pumps, they can produce markedly lower energy bills - **30 percent to 40 percent lower**, according to estimates from the U.S. Environmental Protection Agency, who now includes geothermal heat pumps in the types of products rated in the EnergyStar® program. Because they are mechanically simple and outside parts of the system are below ground and protected from the weather, maintenance costs are often lower as well."*

There has been considerable discussion with Commission staff regarding the issue of classifying GHP as an energy efficiency measure or a renewable energy technology or both. In the 2012 IEPR Update the Commission defines geothermal heat pumps as a renewable technology.

"Different renewable technologies face different barriers. Examples:

- *Geothermal heat pumps, although not an emerging technology, still face barriers to widespread penetration with the biggest challenges being upfront cost, securing financing, and permitting."*

Geothermal heat pump systems deliver significant benefits including:

- Savings in primary energy
- Reduced carbon dioxide (CO_2) emissions
- Reduced summer electrical peak demand
- Savings in consumer energy expenditures

Retrofitting 2.9 million homes (23% market penetration) with geothermal heat pump systems could achieve the Governor's 12GW distributed generation by 2020.

Update:
From the last meeting of the Working Group; CARB staff brought up the point that a utility-base ground loop lease program would affect the RPS requirement for a utility in that it would reduce of the overall electricity production needs.

Conclusion (This will not be a stated policy):

The Energy Commission will not consider the possibility of granting utility owned Ground Source Heat Pumps a Renewable Portfolio Standards Credit.

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Comment: Is this a conclusion that needs to be stated in this document? If yes, it seems it would be by inclusion a stated policy.

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Proposed Policy:
The Commission should evaluate the need for adding a "non-generating renewable technology" definition to the RPS and suggest a path for RPS inclusion of non-generating renewable technologies such as solar thermal and geothermal heat pump loops.

The Commission should work CPUC and utilities to develop financial metrics and societal benefits of inclusion of loops as a utility asset.

The Commission should work CPUC, utilities and other stakeholders to develop a framework for creating a One Million Geo Yards program similar to the One Million Solar Roofs program but quite different in that the primary financial incentives should come from utility based loop ownership and financing programs and not direct public investment.

Issue 4. The Energy Commission currently uses time dependent valuation (TDV) calculations to estimate the upstream impact of energy efficiency measures for the Building Energy Efficiency Standards on an hourly basis. During the rulemaking phase for the Building Energy Efficiency Standards, the TDV calculations are used to estimate the energy savings and associated greenhouse gas emission savings of the efficiency measures on an hourly basis over California as a whole. However, the current methodology would not be applicable to individual installations of ground source heat pumps (or any efficiency measure). While the energy savings estimated correspond to local climate zones within California, the estimated greenhouse gas savings apply to California only as a whole. To predict the impacts on greenhouse gas emissions from a single installation of any efficiency measure would require knowledge of the hourly electric energy resource mix of the utility supplying that power. Such an effort is currently impractical. Therefore, the Energy Commission can estimate statewide greenhouse gas emission savings from predicted ground source heat pump installations, but not individual installations.

The California Air Resources Board has designed a California cap-and-trade program that is enforceable and meets the requirements of AB 32. Offset credits are greenhouse gas emission savings that meet regulatory criteria (see Sub-article 13 of the Cap and Trade Regulations) and may be used by a regulated entity to meet compliance obligations under the Cap-and-Trade Program. The Energy Commission encourages the ground source heat pump industry to pursue and satisfy the significant requirements for Greenhouse Gas Offset Credits under the Cap and Trade Program.

In the February 29, 2012 Public Interest Energy Research Staff Workshop Bill Glassley (CGEC) presented preliminary findings of a recent PIER Program Study.

Assessing the Impact of Geothermal Heat Pump Deployment

Impact of GHP Deployment on Energy Use:

Energy use, per residence, varies greatly between zones climate zones. If averaged together, the energy for HVAC per household would be reduced by 44%. Greatest savings in energy comes from climate zones dominated by heating loads.

Impact of GHP Deployment on Atmospheric Emissions

Total atmospheric emissions (CO_2, NOx and SO_2) correlate with energy use. If averaged together, the total emissions per household would be reduced by about 40%. Nearly all of this is from reduction in CO_2.

Proposed Policy:

The Energy Commission should consider the potential impacts of ground source heat pumps on greenhouse gas emissions using the TDV calculation methodology if estimated installations can be obtained or developed.

~~–~~If estimated installations can't be obtained or developed the Commission should work with academia, industry and other stakeholders to develop a suitable means of assessing the potential impacts of ground source heat pumps on greenhouse gas emissions.

~~Additionally, t~~The Energy Commission should work with the California Air Resources Board to evaluate under what conditions that a ground source heat pump installation can be granted carbon credits (by CARB) under the Greenhouse Gas Cap-and-Trade Program.

The Energy Commission should work with the California Air Resources Board to determine the need for defining the benefits of and pathway for including non-combustive energy efficiency measures into the Greenhouse Gas Cap-and-Trade Program, ie; CO_2 → EE

The Energy Commission should include a comparison of GHG creation at load in the t24 compliance tools.

Update:

From the last working group meeting, CARB staff indicated that this was likely to be unfruitful for the industry given the significant requirements set for a credit under the Cap-and-Trade program. However, they reiterated the point that a GSHP would reduce the electricity generation needs of a utility and thus reduce the need for carbon credits.

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Issue 5. The concept of a utility-based loop lease program is that a utility installs, maintains, and owns the ground source heat pump loop-piping network for the heat pump system, while the customer owns and maintains the heat pump itself. The utility charges customers either a monthly fee or a usage charge based on a BTU meter reading to supply geothermal energy.

The OBR Charter requires utilities to provide OBR methods to 3rd parties only if the technology is included in the utility's rebate portfolio. Consumers should have some say in which technologies they want to install in their homes and businesses.

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Plumas-Sierra Rural Electric Cooperative
Plumas offers a 30-year, non-transferrable, interest free loan for ground source heat pump installations. The monthly payment is added to the customer's monthly electric bill and the amount of the loan is based upon the size of the GSHP loop installed.

- Installations total over 450 systems to date.
- Monthly loop payments for a 4-ton system would be $14.95 for a horizontal loop and $29.95 for a vertical bore field.
- As an incentive, a new 85-gallon water heater is offered free of charge. The addition of "de-super-heater" waste heat capacity further reduces energy usage.
- Plumas-Sierra calculates annual heating savings of over $2,000 versus propane.

Update:
Staff has been recently contacted by a consulting firm representing a local utilitiy in California interested in a pilot project for a new subdivision of residential buildings that would be based on GSHP technology for heat and cooling.

Proposed Policy:
In conjunction with the California Public Utilities Commission, the Energy Commission should investigate the extent to which utility-based loop lease programs with on-bill repayment for both residential and nonresidential applications can be encouraged.

In conjunction with the California Public Utilities Commission, the Energy Commission should investigate the need for increased utility incentives for GHP and the need for modification of the OBR Charter.

Issue 6: Currently, the State of California does not collect well log data in a systematic way. Other states (Missouri, New Jersey, Idaho, Washington and Oregon) not only collect well log data on a state level, they are generally made public via a web-portal.

Well logging, also known as borehole logging is the practice of making a detailed record (a well log) of the geologic formations penetrated by a borehole. The log may be based either on visual inspection of samples brought to the surface (geological logs) or on physical measurements made by instruments lowered into the hole (geophysical logs). Well logging can be done during any phase of a well's history; drilling, completing, producing and abandoning. Well logging is performed in boreholes drilled for the oil and gas, groundwater, mineral and geothermal exploration, as well as part of environmental and geotechnical studies. Such data would be extremely useful to ground source heat pump installations.

The current California law considers water well information private information. Reports submitted on water wells, monitoring wells, or cathodic protection wells are subject to California Water Code Section 13752. Reports submitted on geothermal heat exchange wells and boreholes are open for public inspection.

Update:
Energy Commission staff has been seeking a likely repository for a well-log database. Likely candidates include the Department of Water Resources and the Department of Oil, Gas and Geothermal.

Proposed Policy:
The Energy Commission staff, working with the Department of Water Resources, will investigate the feasibility of developing a web-based well log resource for California.

Additionally, the Energy Commission will continue to add case studies of ground source heat pumps to the existing Negatherm web site as they become available.
Comment: Which website? The Project Negatherm project website, http://projectnegatherm.org/, is currently maintained by WebSynergetics (Phil Henry) the IT subcontractor for Project Negatherm. The existing Project Negatherm site should be molded into fully maintained public and regulatory informational website.

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The Commission should work with the DWR to require all reports on geothermal heat exchange wells and boreholes that are submitted as part of satisfying a drilling report to be posted on a central website (does this need to be by County or at the State level?) for public access. This requirement could be implemented with the new "Geothermal Heat Exchange Well" Standard currently addressed under Issue 1.

Issue 7: The tiered rate structure disincentivizes GHPs and penalizes consumers for choosing GHPs as a means of contributing to the AB32 effort by eliminating fossil fuel combustion for space heating and DHW production in their homes and businesses.

Discussion:

Proposed Policy:
The Commission should work with the CPUC to determine the benefits of creating a preferential rate for ratepayers that deploy GHPs.

Issue 8: HERS rating and inspection protocols not defined for GHP

Discussion:

Proposed Policy:
The Commission should work with the GHP industry to quickly develop effective HERS rating and inspection protocols.

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